

Transportation Control Measure Replacement of 241-91 Express Connector with Three Signal Synchronization Corridor Projects

Introduction

The Foothill/Eastern Transportation Corridor Agency (TCA) previously committed to funding of an Express Lane Connection (ELC) between of State Route (SR)-241 and the 91 Express Lanes as a single transportation control measure (TCM). This new connector would have a single lane in each direction by December 2020. However, recent updates to the ELC project have moved to the scheduled completion date beyond December 2020. OCTA is now proposing three traffic signal synchronization (TSS) projects along Brookhurst Street, El Toro Road, and Magnolia Boulevard as a single replacement TCM to the previously planned ELC in the Federal Transportation Improvement Program (FTIP). The proposed evaluation assumptions, methodology, and results are discussed below.

Project Description

The TSS projects will improve signal equipment, close infrastructure gaps, and synchronize traffic signals along three key arterial highways in Orange County: El Toro Road, Magnolia Street, and Brookhurst Street. The projects will be completed by Fiscal Year 2020/2021 (December 2020). The locations of the three traffic signal synchronization projects TCM and 241/91 Express Connector TCM are graphically illustrated in Attachment A.

Compliance with Substitution Requirements

- **Equivalent Emissions Reduction:** OCTA has analyzed the countywide emissions impacts of the substitute TCM (three traffic signal synchronization projects) relative to those of 241/91 Express Connector TCM. The replacement project will provide equivalent emission reductions (See the Air Quality Analysis Findings below).
- **Similar Geographic Area:** Both the three traffic signal synchronization projects TCM and the 241/91 Express Connector TCM are located in the Orange County portion of the South Coast Air Basin.
- **Full Funding:** OCTA has current funding for the three traffic signal synchronization projects TCM.
- **Similar Time Frame:** The proposed three traffic signal synchronization projects TCM will be operational by December 2020, equivalent to the schedule of the 241/91 Express Connector TCM schedule.

- **Timely Implementation:** The proposed substitution is the means by which the obstacles to implementation of the 241/91 Express Connector TCM is being overcome.
- **Legal Authority:** OCTA has legal authority and personnel to implement and operate the substitute three signal synchronization projects TCM.

Air Quality Analysis Methodology

The air quality impacts were calculated for the existing 241/91 Express Connector TCM and the proposed three traffic signal synchronization projects TCM using a multi-step method based on the SCAG emission methodology focused on Orange County. The following process was used:

Step 1: Obtain daily vehicle miles traveled (VMT) and speed data for freeways and arterials from the Orange County Transportation Analysis Model 4.0 (OCTAM). OCTAM is a conventional four step transportation model used to forecast travel demand with a base year of 2012 (sometimes referred to as the existing year) and a forecast year of 2040. It is consistent with SCAG's regional travel demand model as it incorporates the most recent approved socio-economic data for Orange County and the surrounding region.

Two alternatives for forecast year 2040 were run using OCTAM as part of this study. The coding of all alternatives is consistent with previous OCTAM modeling practices.

The three traffic signal synchronization projects will improve signal equipment, close infrastructure gaps, and synchronize traffic signals along three key arterial highways in Orange County: El Toro Road, Magnolia Street, and Brookhurst Street. Nearly \$3.4 million in improvements will result from this effort. The projects involve 16 jurisdictions and will improve traffic along 40 miles of arterial highways and 128 signals. 1.1 million vehicle miles are traveled along the project limits.

The 241/91 Express Connector consists of constructing direct connector ramps between SR-241 and the 91 Express Lanes. The ramps connect northbound SR-241 with the eastbound 91 Express Lanes, and the westbound 91 Express Lanes with southbound SR-241. Consistent with the current policies on SR-241 and the 91 Express Lanes, the connector ramps are assumed to be only available to drivers willing to pay a toll. The project is programmed and budgeted in the FTIP. This alternative was used for the 241/91 Express Connector TCM "with project" analysis.

Both alternatives were modeled separately using OCTAM and post-processed using the National Cooperative Highway Research Program (NCHRP) 255 process. This process provides a standard methodology to refine forecasted volumes on links based on a combination of base year traffic counts, base year model estimates, and

forecasted model estimates using incremental adjustments. The output of the travel demand model and post-processing included travel information on both the three traffic signal synchronization TCM and the 241/91 Express Connector TCM. Loaded link information, intrazonal travel speeds, and intrazonal travel volumes were extracted for all modeled time periods for both alternatives.

Step 2: The Emission Factors (EMFAC2014) model was developed by the California Air Resources Board and is used throughout California to calculate emission rates from motor vehicles, such as passenger cars and heavy-duty trucks, operating on freeways and local roads for typical summer, winter, and annual conditions. EMFAC model outputs include total emissions for all criteria pollutants for all Orange County.

A spreadsheet tool has been created to modify EMFAC input data to reflect the results of OCTAM runs. The tool was run for the base year and forecast year 2040 using the extracted information from Step 1 as input to update the VMT and vehicle speed data needed by EMFAC. This process was performed multiple times for each modeled alternative in order to analyze conditions for summer, winter, and averaged annual timeframes.

Note that interpolation of travel activity data between base year 2012 and forecast year 2040 results was used to estimate the emissions changes for interim year 2021 and 2031.

Step 3: Determine the emissions output from Step 2 (see Attachments B-D) to identify the potential emissions-related impacts of the 241/91 Express Connector TCM and three traffic signal synchronization projects.

Findings

The air quality forecasts for the three traffic signal synchronization projects TCM were compared with those of the 241/91 Express Connector TCM using the methodology described in the previous section. Criteria pollutants (Ozone, CO, NO₂, PM_{2.5} and PM₁₀) were compared for three forecast years (2021, 2031, and 2040) as well as three seasons (summer, winter, and annual) and their results are summarized in the tables below.

Year 2021

Summer Emissions - Ozone (Tons/Day)

	With Express Connector	With Traffic Signal Synchronization
ROG	16.4	16.4
NOx	28.4	28.4

Carbon Monoxide, Nitrogen Dioxide - Winter Emissions (Tons/Day)

	With Express Connector	With Traffic Signal Synchronization
NO2	30.0	30.0
CO	127.1	127.1

PM₁₀, PM_{2.5} - Annual Emissions (Tons/Day)

	With Express Connector	With Traffic Signal Synchronization
ROG	16.2	16.2
NOx	30.6	30.6
PM10	4.4	4.4
PM2.5	2.1	2.1

Year 2031

Summer Emissions - Ozone (Tons/Day)

	With Express Connector	With Traffic Signal Synchronization
ROG	9.5	9.5
NOx	14.0	14.0

Carbon Monoxide, Nitrogen Dioxide - Winter Emissions (Tons/Day)

	With 241 Extension	With Traffic Signal Synchronization
NO2	14.7	14.7
CO	67.3	67.3

PM₁₀, PM_{2.5} - Annual Emissions (Tons/Day)

	With 241 Extension	With Traffic Signal Synchronization
ROG	9.3	9.3
NOx	15.0	15.0
PM10	4.3	4.3
PM2.5	1.8	1.8

Year 2040

Summer Emissions - Ozone (Tons/Day)

	With Express Connector	With Traffic Signal Synchronization
ROG	6.7	6.7
NOx	8.3	8.3

Carbon Monoxide, Nitrogen Dioxide - Winter Emissions (Tons/Day)

	With Express Connector	With Traffic Signal Synchronization
NO2	8.6	8.6
CO	43.4	43.7

PM₁₀, PM_{2.5} - Annual Emissions (Tons/Day)

	With Express Connector	With Traffic Signal Synchronization
ROG	6.6	6.6
NOx	8.7	8.7
PM10	4.2	4.2
PM2.5	1.7	1.7

In summary, the modeling results demonstrate that the proposed three traffic signal synchronization projects TCM will have the same or lower amount of emissions compared with the 241/91 Express Connector TCM for all criteria pollutants for all milestone years.

Attachments

- A. Signal Synchronization Transportation Control Measure Substitution Map
- B. 2021 241/91 Express Connector and Traffic Signal Synchronization Projects Emissions Results
- C. 2031 241/91 Express Connector and Traffic Signal Synchronization Projects Emissions Results
- D. 241/91 Express Connector and Traffic Signal Synchronization Projects Emissions Results

ATTACHMENT B**2021 241/91 Express Connector and Traffic Signal Synchronization Projects
Emissions Results****All Emissions Summary | Annual | Process:All | Technology:All**

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	16.7	128.2	30.6	0.3	18.1	16.2	29,608	4.4	2.1	29,830	3,093
Replacement - TSS Projects	16.7	128.2	30.6	0.3	18.1	16.2	29,602	4.4	2.1	29,824	3,092

All Emissions Summary | Summer | Process:All | Technology:All

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	16.9	128.9	28.4	0.3	18.3	16.41	30,524	4.4	2.1	30,745	3,190
Replacement - TSS Projects	16.9	128.9	28.4	0.3	18.3	16.41	30,517	4.4	2.1	30,739	3,190

All Emissions Summary | Winter | Process:All | Technology:All

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	17.9	127.1	30.0	0.3	19.4	17.5	29,263	4.4	2.1	29,487	3,056
Replacement - TSS Projects	17.9	127.1	30.0	0.3	19.4	17.5	29,257	4.4	2.1	29,481	3,055

ATTACHMENT C

**2031 241/91 Express Connector and Traffic Signal Synchronization Projects
Emissions Results**

All Emissions Summary | Annual | Process:All | Technology:All

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	9.7	68.0	15.0	0.3	10.5	9.3	25,137	4.3	1.8	25,261	2,593
Replacement - TSS Projects	9.7	68.0	15.0	0.3	10.5	9.3	25,126	4.3	1.8	25,250	2,592

All Emissions Summary | Summer | Process:All | Technology:All

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	9.9	68.7	14.0	0.3	10.7	9.5	25,864	4.3	1.8	25,988	2,670
Replacement - TSS Projects	9.9	68.7	14.0	0.3	10.7	9.5	25,852	4.3	1.8	25,976	2,669

All Emissions Summary | Winter | Process:All | Technology:All

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	10.4	67.3	14.7	0.2	11.3	10.1	24,860	4.3	1.8	24,986	2,564
Replacement - TSS Projects	10.4	67.3	14.7	0.2	11.3	10.1	24,849	4.3	1.8	24,974	2,562

ATTACHMENT D

**2040 241/91 Express Connector and Traffic Signal Synchronization Projects
Emissions Results**

All Emissions Summary | Annual | Process:All | Technology:All

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	6.9	43.9	8.7	0.2	7.5	6.6	23,349	4.2	1.7	23,434	2,393
Replacement - TSS Projects	6.9	43.8	8.7	0.2	7.5	6.6	23,335	4.2	1.7	23,420	2,392

All Emissions Summary | Summer | Process:All | Technology:All

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	7.1	44.7	8.3	0.2	7.6	6.7	24,000	4.2	1.7	24,085	2,462
Replacement - TSS Projects	7.1	44.6	8.3	0.2	7.6	6.7	23,985	4.2	1.7	24,071	2,461

All Emissions Summary | Winter | Process:All | Technology:All

All Vehicles	Pollutants (tons)										Fuel (1000 gals)
	HC	CO	NOx	SOx	TOG	ROG	CO ₂	PM10	PM2_5	Total	
Baseline - 241-91 Connector	7.5	43.4	8.6	0.2	8.0	7.1	23,099	4.2	1.7	23,185	2,367
Replacement - TSS Projects	7.5	43.4	8.6	0.2	8.0	7.1	23,086	4.2	1.7	23,172	2,365